THE INHERITANCE OF NUMBER OF SEEDS PER POD AND LEAFLET SHAPE IN THE SOYBEAN

BY

WAYNE ELWIN DOMINGO

B. S., University of Nebraska, 1938
M. S., Utah State Agricultural College, 1940

AN ABSTRACT

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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ACKNOWLEDGMENT

The writer wishes to express his sincere appreciation for the helpful advice and suggestions of Dr. C. M. Woodworth during the course of these investigations and the writing of the thesis.

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The character "number of seeds per pod" is one of several characters which contribute to yield in the soybean, *Soja max* (L.) Piper. A clear understanding of the inheritance of these characters, as well as of the relations between them, is necessary in order to ascertain more accurately the possibility of obtaining all of them in the highest degree in one variety. This study concerned the inheritance of number of seeds per pod and leaflet shape. The latter character was included because of certain evidences of linkage between it and number of seeds per pod.

Inheritance of Number of Seeds per Pod

The plants of a given soybean strain have either a majority of one-, two-, three-, or four-seeded pods or large percentages of any two consecutive classes from one to four. There is little variation in seeds-per-pod values of plants within a variety. The several parental strains used in crosses had mean seeds-per-pod values ranging from 1.05 ± 0.01 to 3.59 ± 0.03. Most of the strains had "intermediate" mean seeds-per-pod values ranging from 2.09 to 2.95. One strain had a "low" mean seeds-per-pod value of 1.05. Two strains had "high" seeds-per-pod means of 3.38 and 3.59.

That this character is not wholly uninfluenced by environmental factors is shown by the fact that in a few cases the mean seeds-per-pod values of different entries of a strain planted at different locations in the field differed significantly.

All six crosses between "low" and "intermediate" varieties showed distinct bimodality in their F_2 seeds-per-pod frequency distributions. Approximately one-fourth of the F_2 segregates had low seeds-per-pod values and constituted the smaller portion of the F_2 curve. Thus a single gene difference between intermediate and low is indicated, with the former being dominant. The symbols *Lo* and *lo* are proposed. The action of several minor genes is suggested since the seeds-per-pod values of the plants constituting the two portions of the F_2 curve did not exactly correspond to those of the two parents.

Twelve F_2 distributions were obtained from crosses between "intermediate" and "high" parents. In each case parental types were recovered in the F_2 segregates. The modal class of each F_2 distribution had a seeds-per-pod value only slightly greater than the mean of the intermediate parent, which suggests dominance of the intermediate type over the high type. Three of the F_2 distributions exhibited bimodality with approximately one-fourth of the plants, those with higher seeds-per-pod values, constituting the smaller portion of the curve. This fact suggests a single gene difference between the intermediate and the high strains. No symbols are proposed since not all of the distributions exhibited the bimodal tendency. Significant positive correlation coefficients were obtained when F_2 seeds-per-pod values were correlated with the mean seeds-per-pod values of their respective F_3 progenies. A negative, but not significant, correlation coefficient was obtained when F_2 seeds-per-pod values were correlated with the coefficients of variability of their respective F_3 progenies.

In both of the crosses between "low" and "high" types (a) no F_2 segregates had seeds-per-pod values equal to the mean of either parent, (b) the value of the modal class of the F_2 distribution was slightly below the average of the 2 parents,

and (c) the F_2 distributions showed a bimodal tendency, with approximately 13% of the segregates with the lower seeds-per-pod values constituting the smaller portion of the curve.

Studies were made of F_2 distributions of eleven crosses made between "intermediate" types. In 7 of the crosses the F_2 means were intermediate between the parental means. In 2 of the crosses the F_2 mean approached the mean of the higher parent. In 2 of the crosses the F_2 mean approached the mean of the lower parent.

Inheritance of Leaflet Shape

All crosses between normal-leaflet types produced only normal-leaflet plants in F_1 and F_2 generations.

All data from normal- x narrow-leaflet types substantiated earlier reports that the narrow type differed from the normal type by the single recessive gene *na*.

Data from the normal- x oval-leaflet crosses indicated that the oval type differed from the normal type by a single recessive gene for which the symbol *o* is proposed. Normal and oval segregates in 2 of the 8 populations did not fit the hypothetical 3:1 ratio. Two facts suggest that these are chance deviations. Both of these crosses had reciprocals whose F_2 segregates fit the ratio. One of the crosses differed from another cross whose segregates fit the ratio only in that the pistillate parent of one was a chlorophyll-deficient mutation from the pistillate parent of the other.

The F_1 plants from oval- x narrow-leaflet crosses had normal leaflets, and the F_2 segregates included normal-, oval-, and narrow-leaflet plants in a 9:3:4 ratio. The genotypes associated with the various phenotypes are normal, *NaO;* oval, *Nao;* and narrow, *naO* and *nao*.

Some of the leaflet-shape segregates were difficult to classify.

In a few crosses several leaflet measurements were made of dimensional relations in which the parents were believed to differ in anticipation of segregation for leaflet indices which would be more precise than segregation for leaflet shape. The indices obtained on parental types and their F_2 generations segregating for leaflet shape were (a) the width of the leaflet at its widest point divided by its length, (b) the distance from the base of the leaflet to its widest point divided by its total length, and (c) the size of the angle formed by the two margins of the basal portion of the leaflet. The F_2 distribution of none of the indices exhibited the discontinuous variation necessary for an index to be of value in the classification of difficult cases.

Linkage Relationships

All F_2 distributions from crosses between the "low" parent, which had oval leaflets, and the "intermediate" parents, which had normal leaflets, showed a marked tendency for low segregates to have oval leaflets. Low segregates with normal leaflets and intermediate segregates with oval leaflets were considered cross-over types and occurred in numbers which indicated approximately 7% crossing over between *lo* and *o*.

Plants of the "high" parents had narrow leaflets. The high segregates from the "intermediate" by "high" crosses showed a marked tendency to have narrow leaflets. In the 3 F_2 distributions which showed a bimodal tendency, high segregates with normal leaflets and intermediate segregates with narrow leaflets were considered cross-over types. Their frequency indicated approximately 9% crossing over between *na* and the high seeds-per-pod gene or genes.

Gene *o* is not linked with *t* for pubescence color. Gene *na* is not linked with *t* for pubescence color or with *f* for fasciation.

VITA

The author was born near Weeping Water, Nebraska, on June 30, 1916. He graduated from Weeping Water High School in 1933. He attended the University of Nebraska from 1934 to 1938, receiving the degree of Bachelor of Science in Agronomy and Vocational Education. For the academic years 1938-39 and 1939-40 he was appointed research fellow in Agronomy at the Utah State Agricultural College from which institution he received the Master of Science degree. For the academic years 1940-41 and 1941-42 he was appointed fellow in Agronomy at the University of Illinois.

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